

[BIOSWOT-Med]: SPASSO Images Analysis

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April 17, 2023

Executive Summary

Welcome to the SWOT age: first ever high resolution SSH images for the Mediterranean sea just released and available below. Late bloom, submesoscale-active situation in the Balearic sea stirred by several small (20km diameter) eddies. Post-bloom situation in the Algerian sub-basin dominated by a meander of the Algerian current that is currently heading north inside the sector of Spanish EEZ claimed by Algeria. Two possible zones of operations are identified: a dipole of small (20km) mesoscale eddies north-east of Menorca; and (pending Algerian authorization) the northern frontier of the meander of the Algerian current. The plan is to monitor the situation and head west out of the Zonex as soon as possible, then to continue south-west in the middle of the eastern SWOT swath for performing a first survey of the potential operation zone north-east of Minorca. Zooglider is working nominally and advancing eastward along the southern edge of the Balearic plateau.

1 Ongoing operations and upcoming stations

SWOT passing time (UTC) over:

43°N - 5°E Asc 42.7°N - 4.8°E Asc
:----- :-----
2023-04-16 21:24:01 2023-04-16 21:24:01
2023-04-17 21:14:38 2023-04-17 21:14:38
2023-04-18 21:05:16 2023-04-18 21:05:16
2023-04-19 20:55:53 2023-04-19 20:55:53
2023-04-20 20:46:31 2023-04-20 20:46:31

2 Daily figures analysis

2.1 SWOT images

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2.2 Altimetry, derived currents

DUACS-derived altimetry SSH and currents.

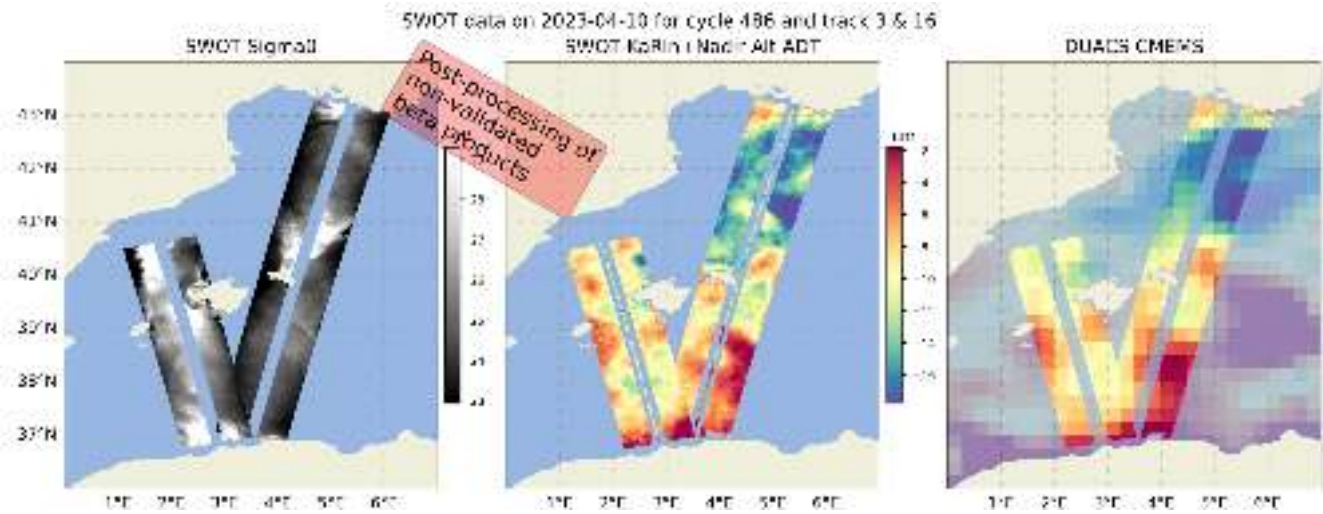


Figure 1: SWOT sigma0 and SSH quick look, 2023/04/10, compared with standard DUACS maps. Note (i) the improvement in resolution from DUACS to SWOT; (ii) the gap between the two SWOT swaths, where there is a conventional nadir altimetry: the middle of the swath is preferable; (iii) the active area 50-100 km northeast from Minorca; (iv) the huge meander introducing the Algerian sub-Basin at 39N. (iii-iv) are two potential zones of operations. The second one requires Algerian authorization.

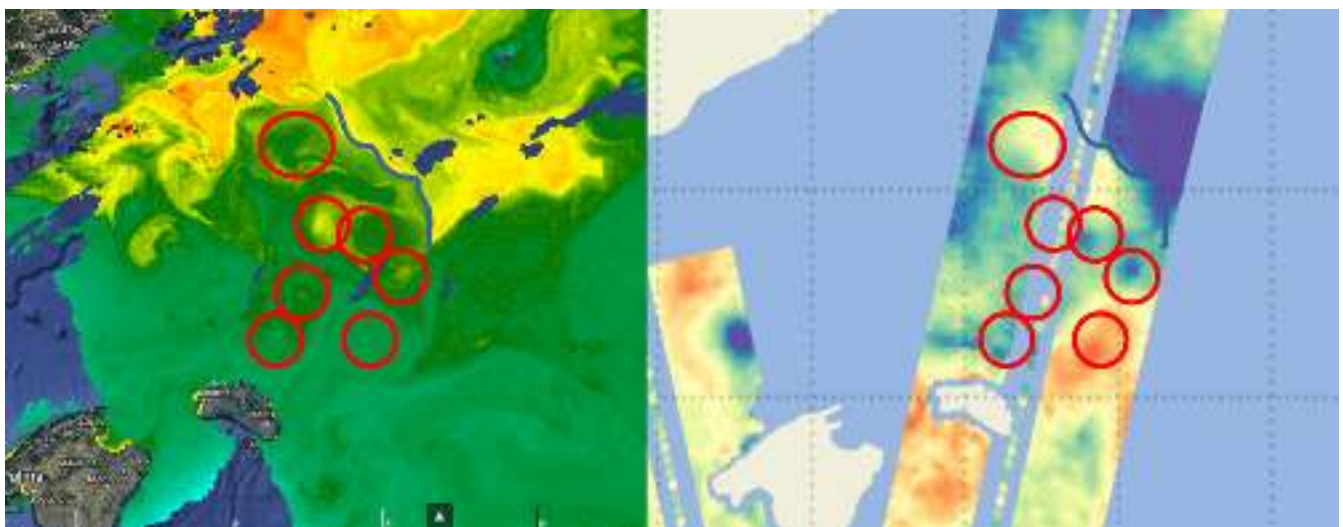
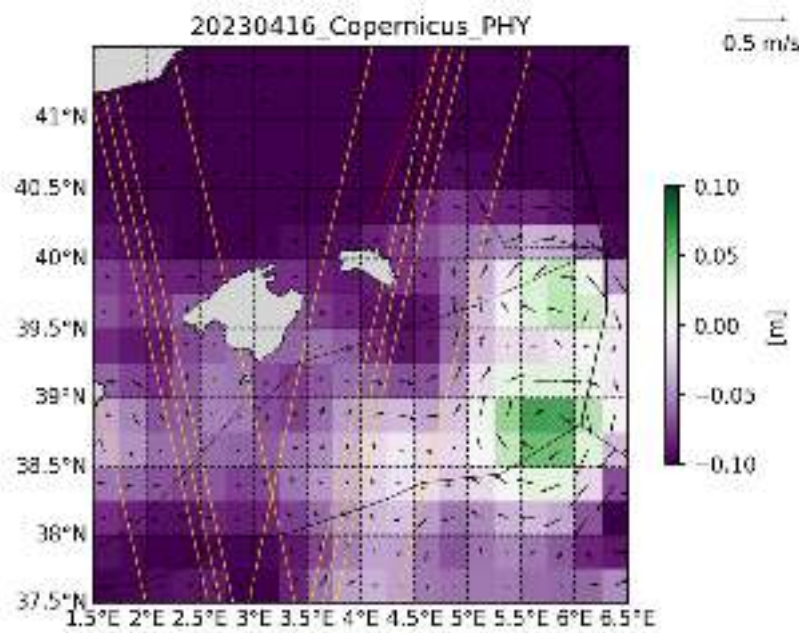
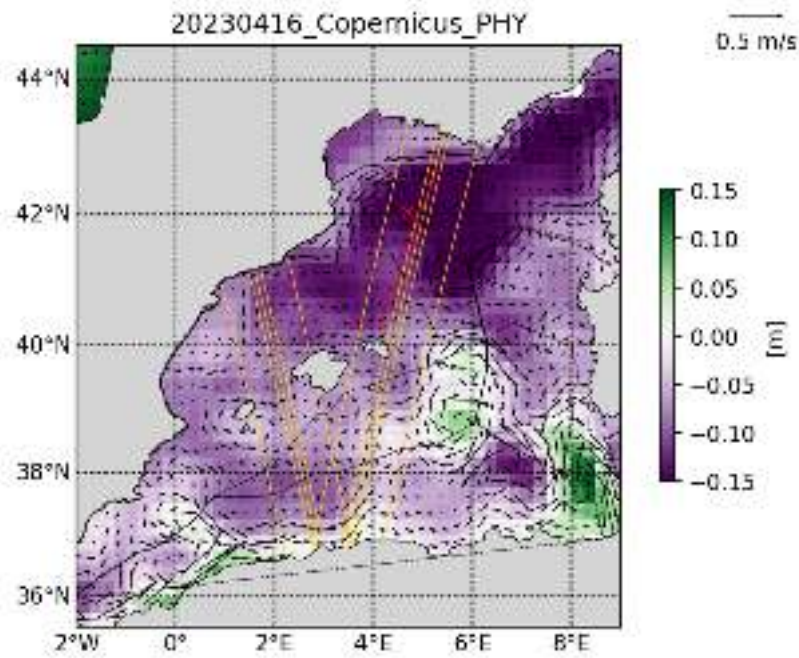
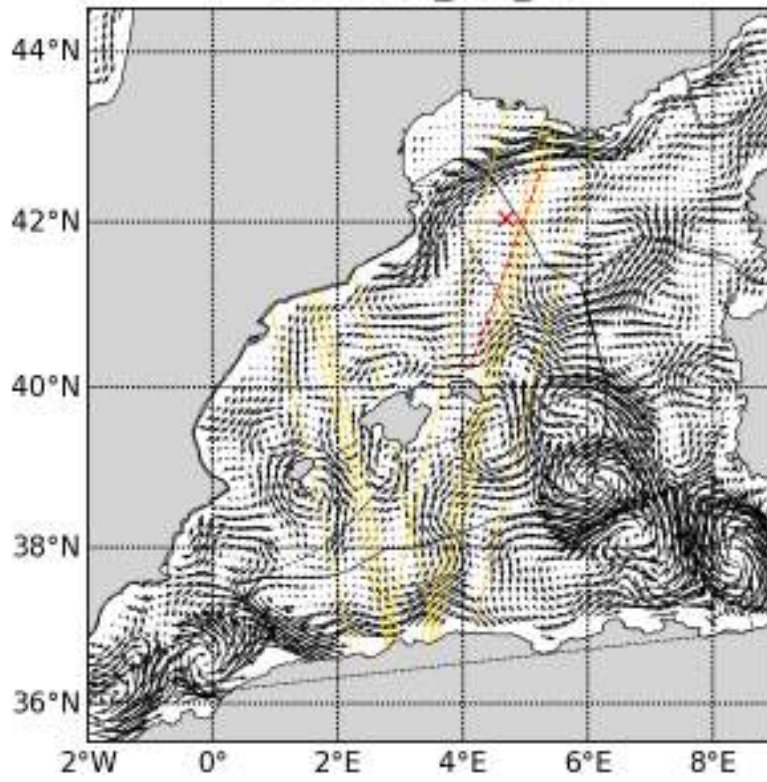


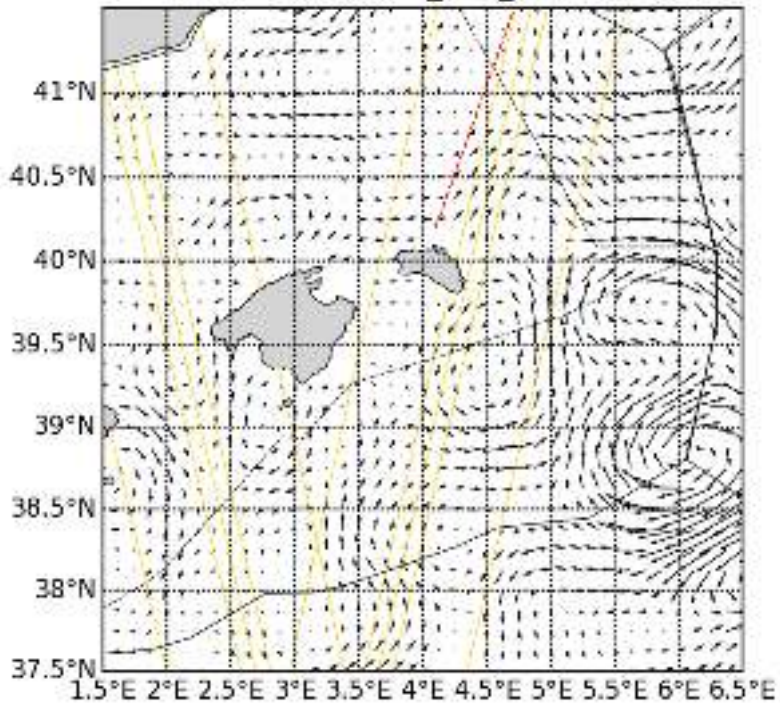
Figure 2: A zoom over one potential zone of operations from the SWOT quick look, 2023/04/10, compared to surface chlorophyll concentration from Sentinel-3. Note that very small eddies, 10-20 km large, are detected by SWOT and have a strong biological signature.

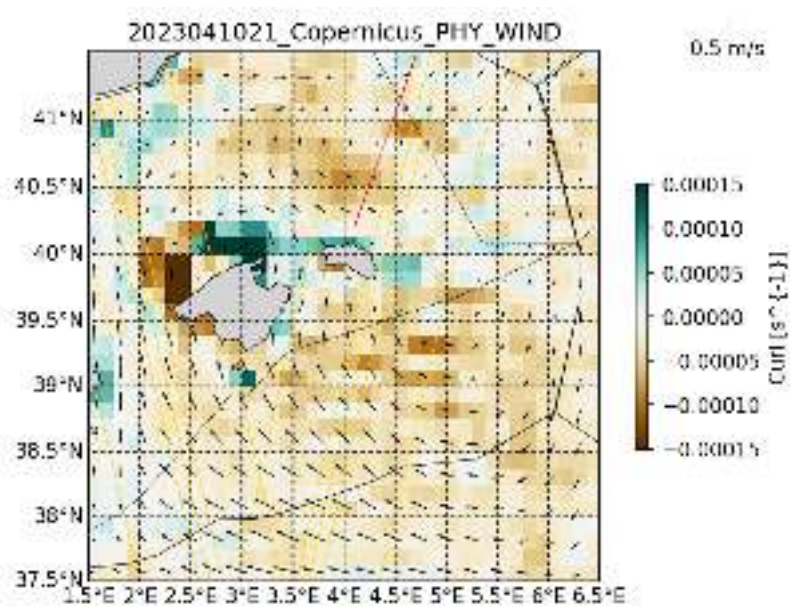
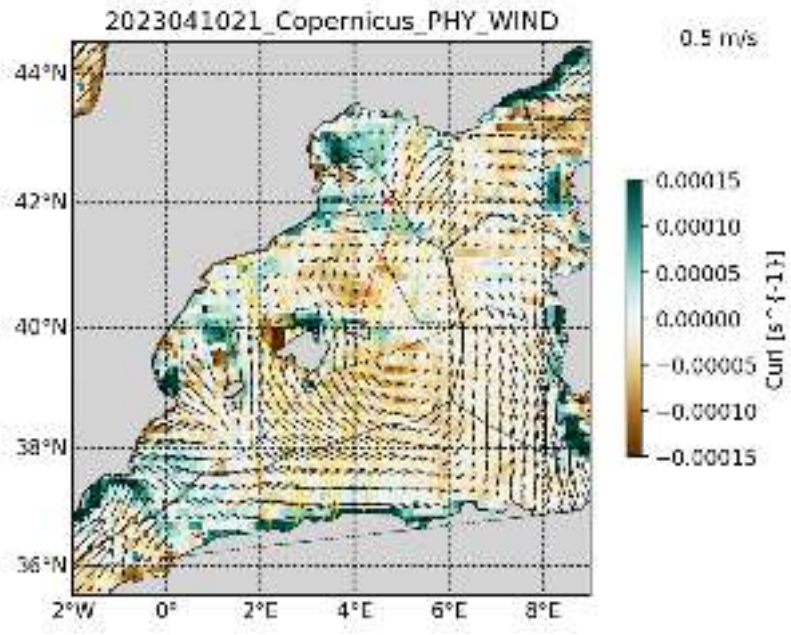


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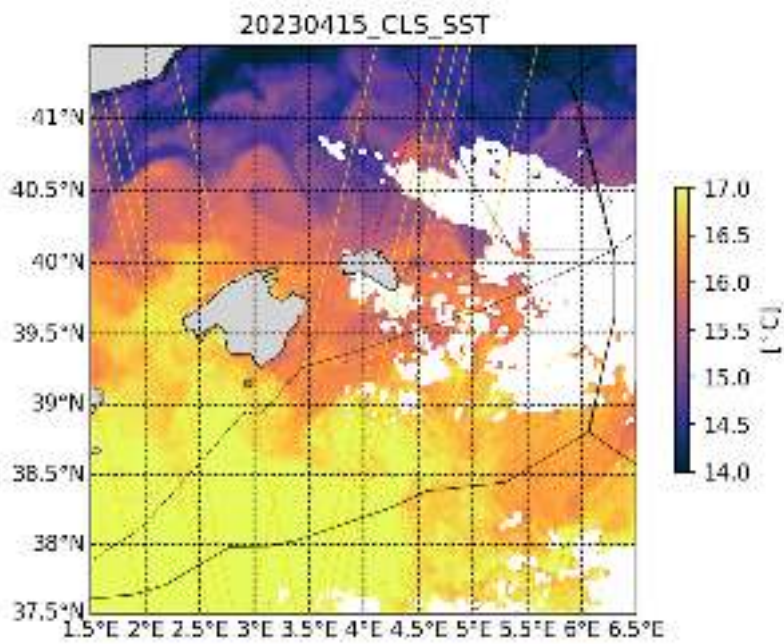
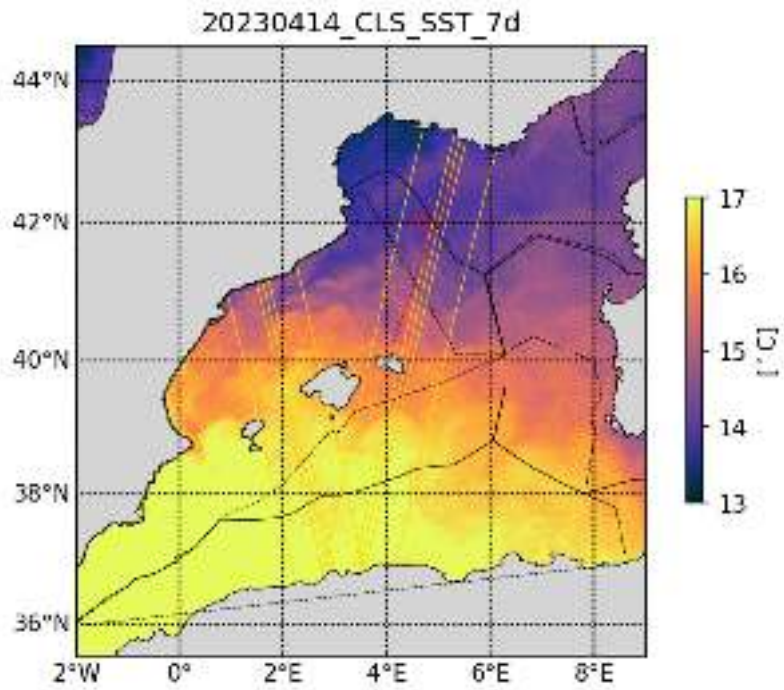
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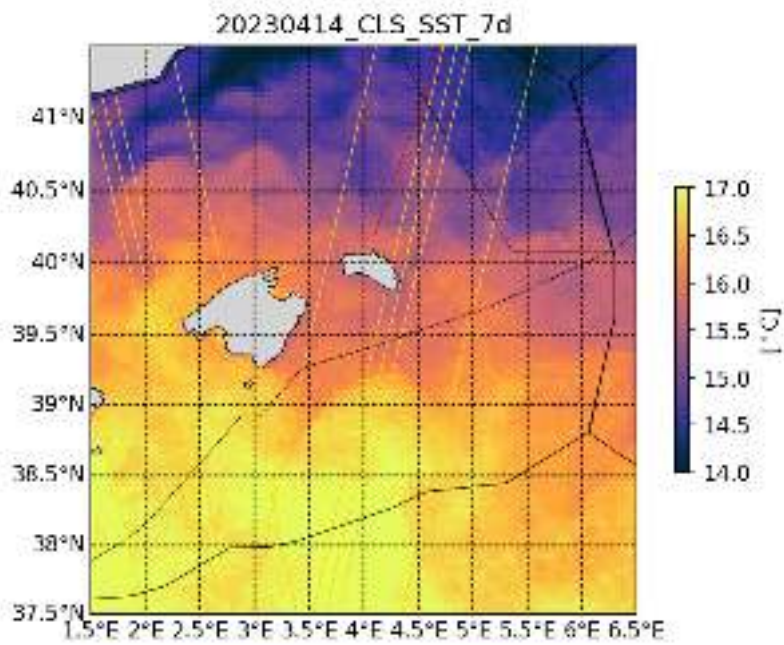
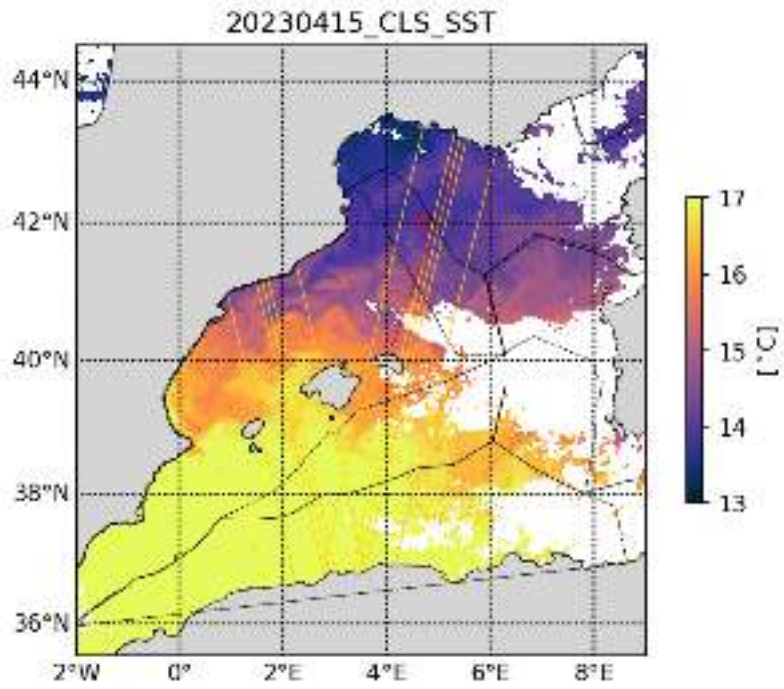


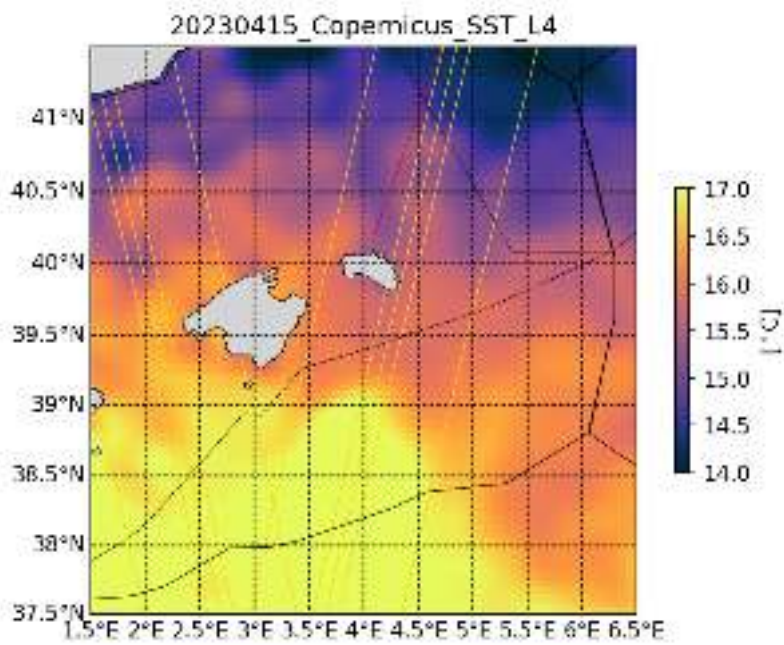
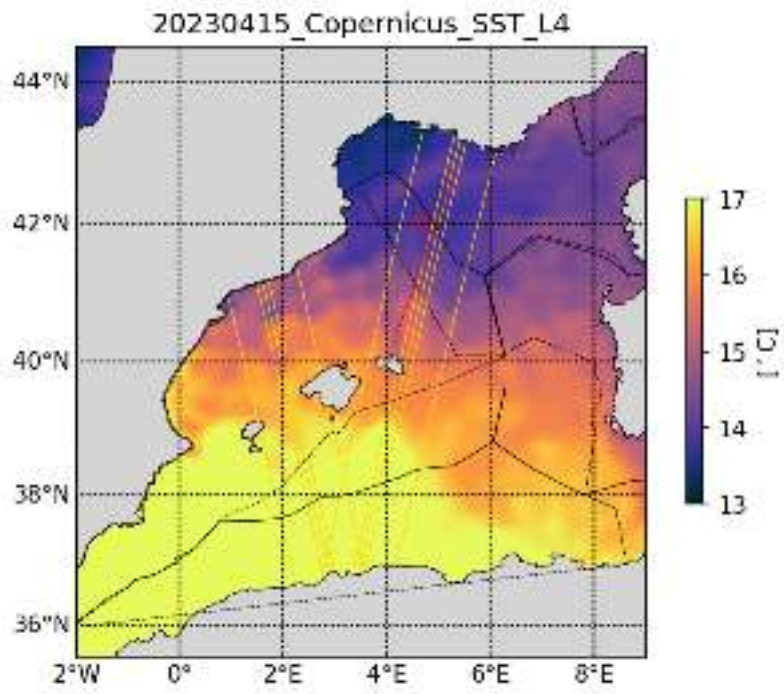


2.3 SST analysis

SST images are consistent with a northward propagation of the meander of the Algerian current and with complex stirring patterns expected by the interactions of several small eddies north-east of Minorca.

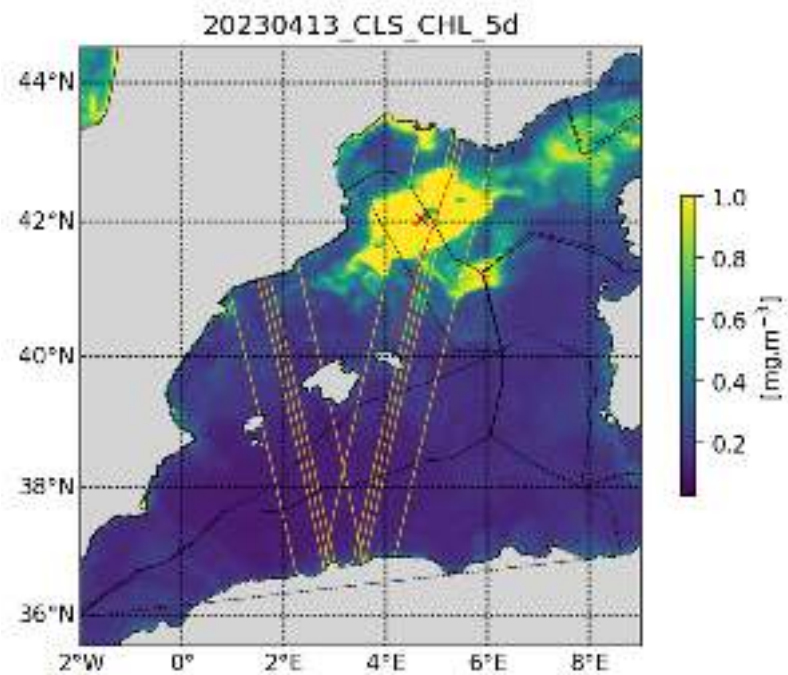
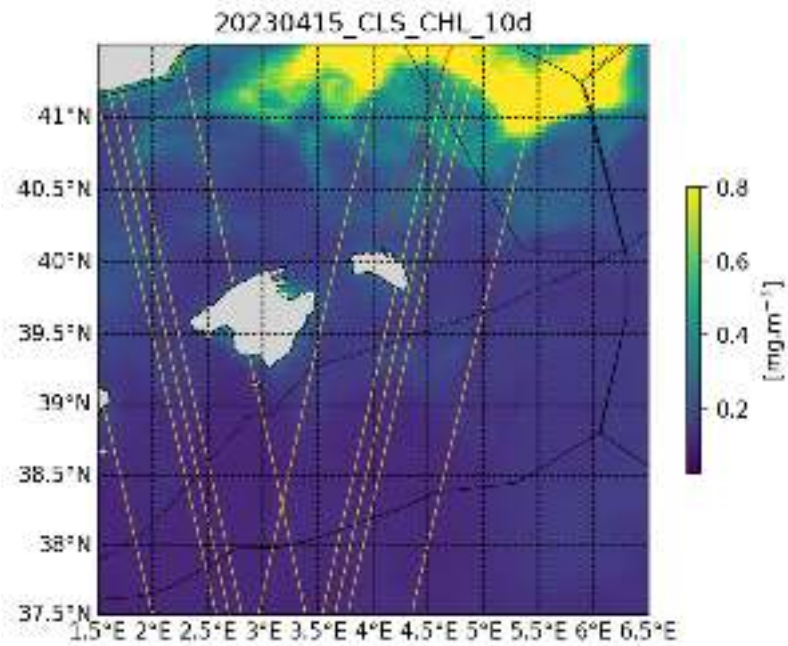


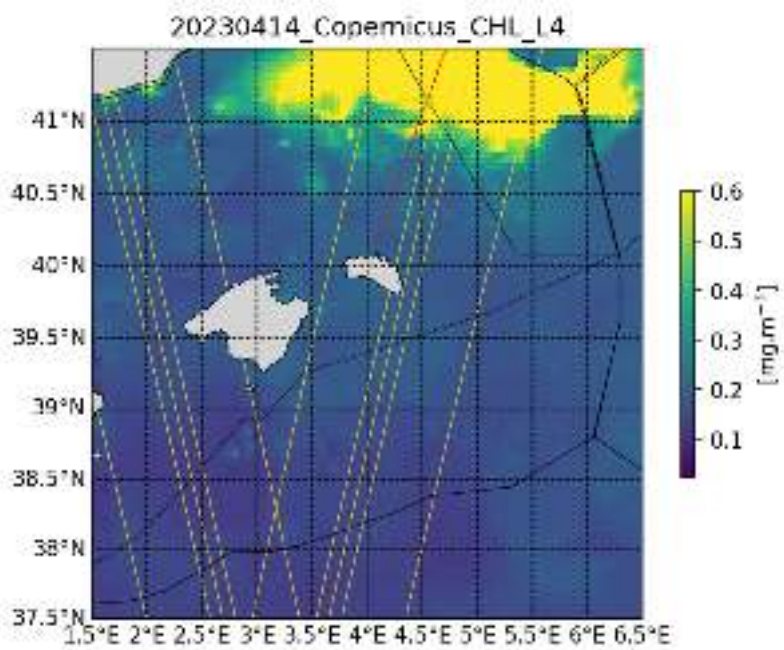
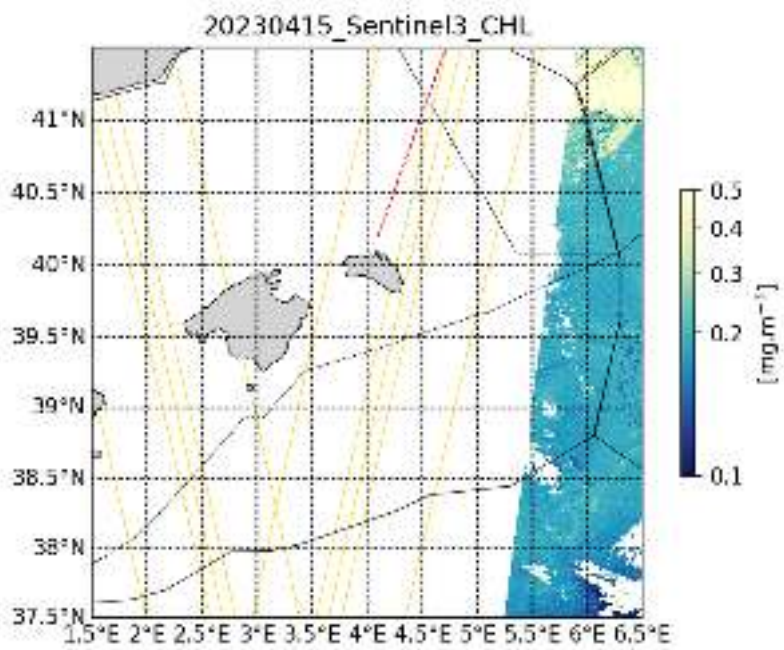


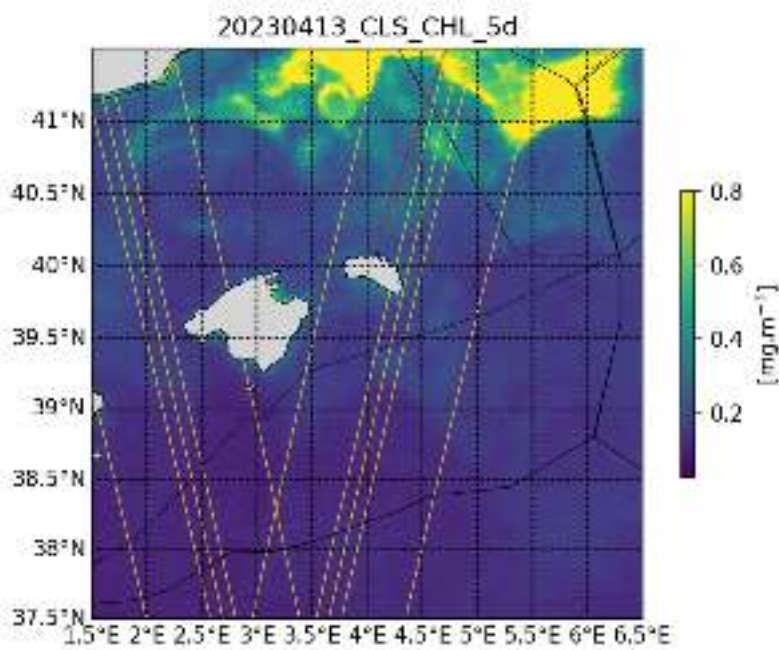
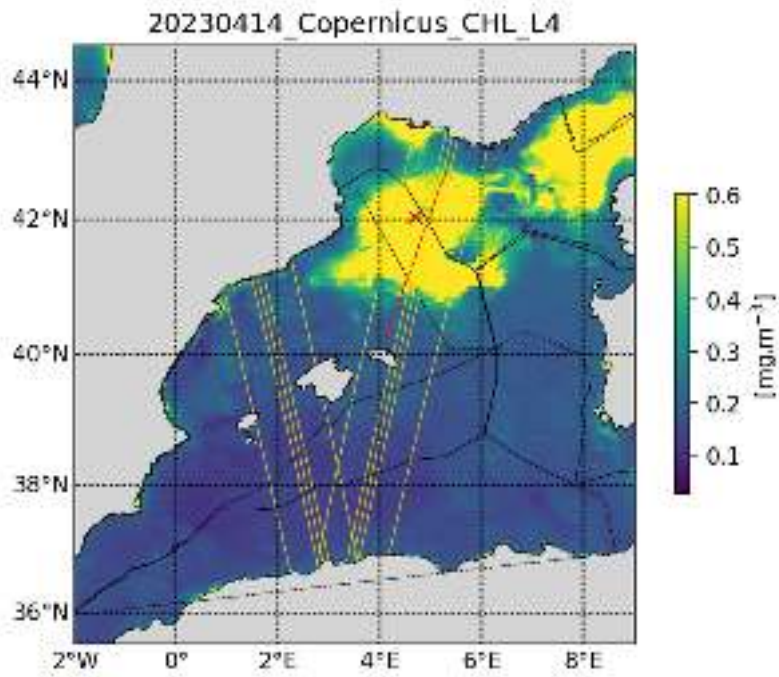


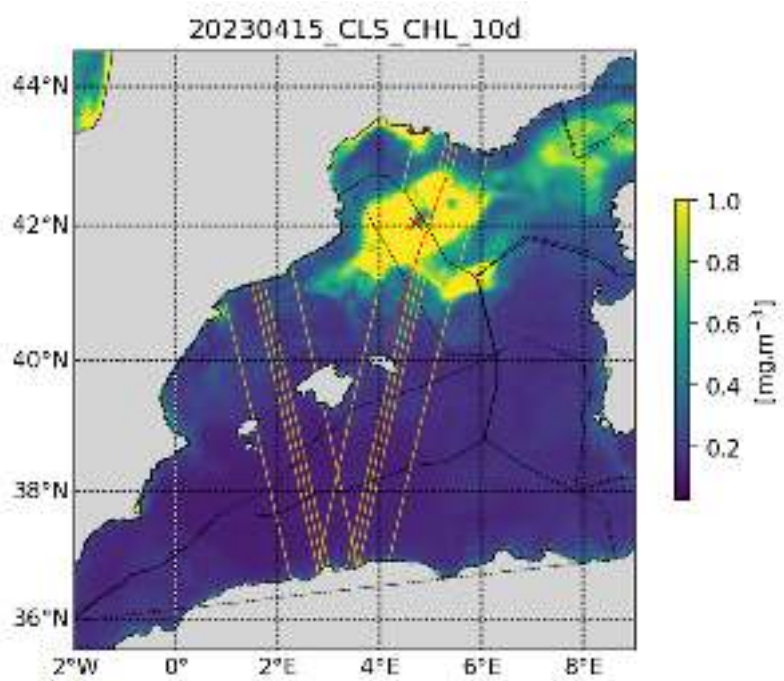
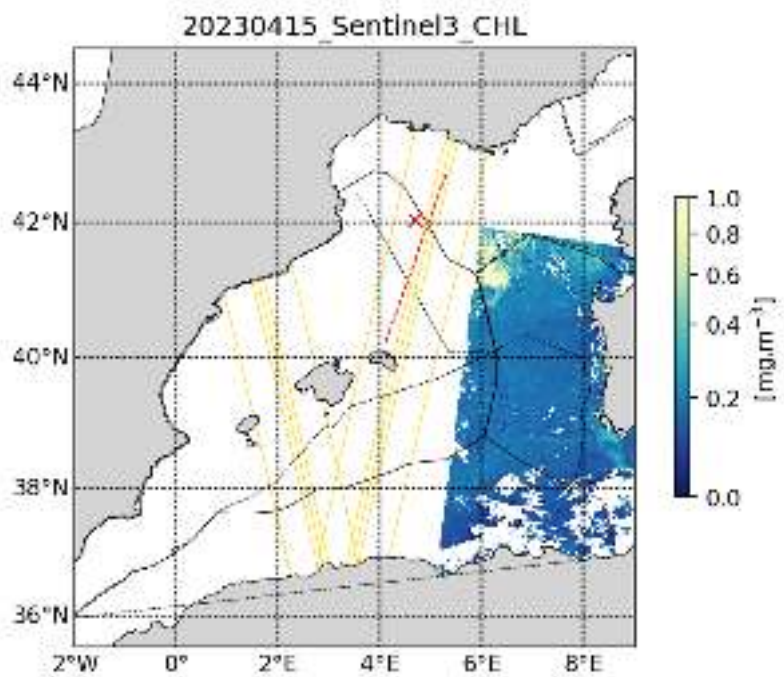
2.4 Chlorophyll analysis

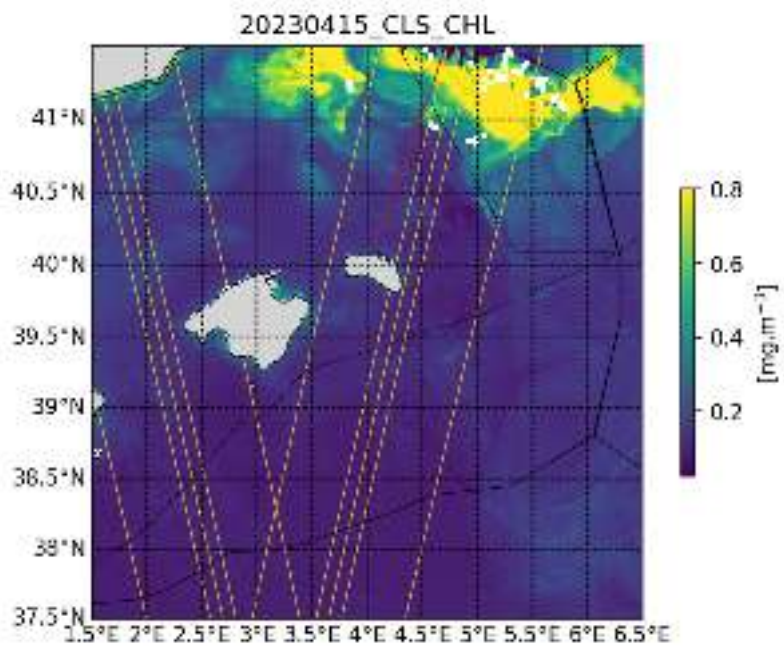
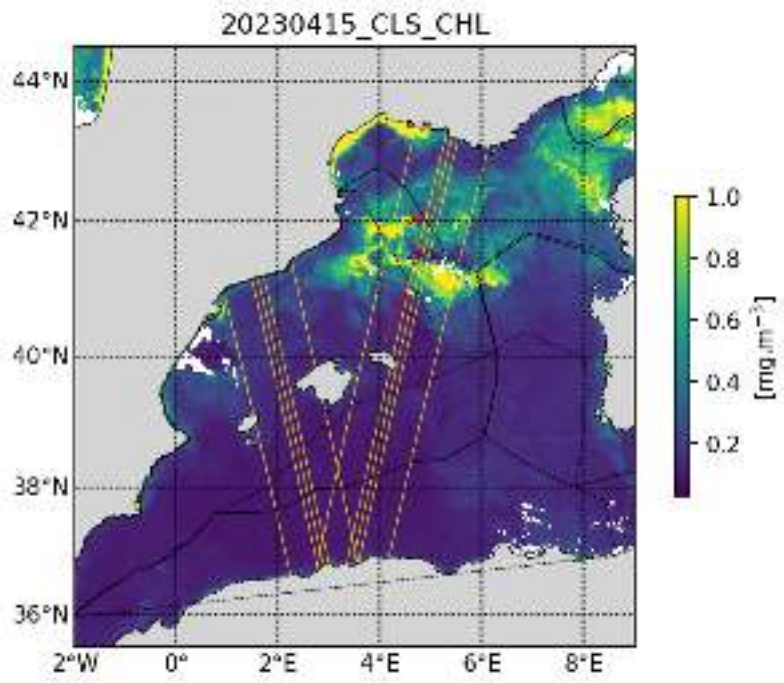
Chl images indicate a late-bloom situation in the Balearic sea and a post-bloom situation over the Algerian sub-basin. Both situations are favorable for our experiment, although in the south less phytoplankton biomass may be present.











2.5 Eulerian/Lagrangian analysis

The Eulerian and Lagrangian analysis does not include SWOT-derived velocity field. The dynamics northern of Minorca is largely missed, and only qualitatively characterized over the Algerian sub-basin.

Eulerian diagnostics computed with Copernicus_PHY velocities:

KE: kinetic energy

OW: Okubo-Weiss parameter

Lagrangian diagnostics computed by seeding Lagrangian particles every 0.02deg and advected for 30 days backward in time with Copernicus_PHY velocities:

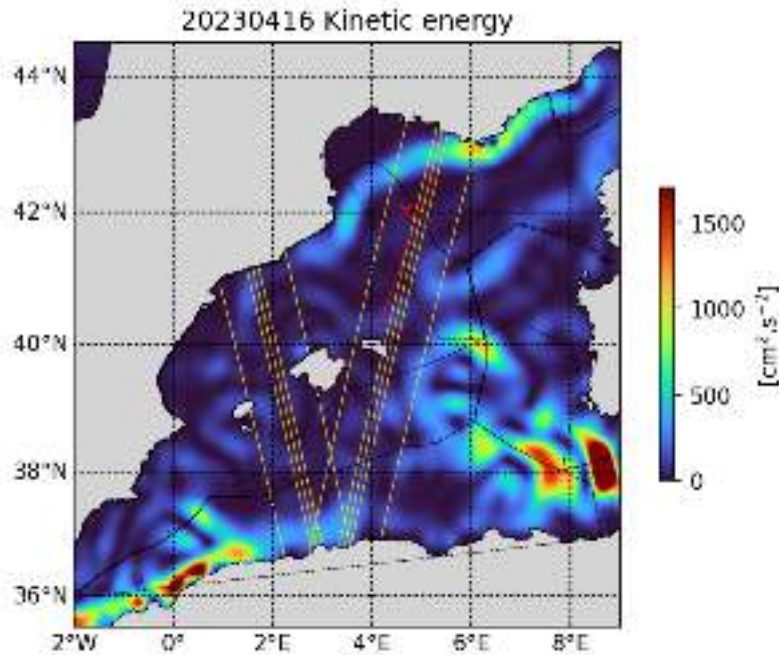
FTLE: finite time Lyapunov exponents (convergent fronts detection)

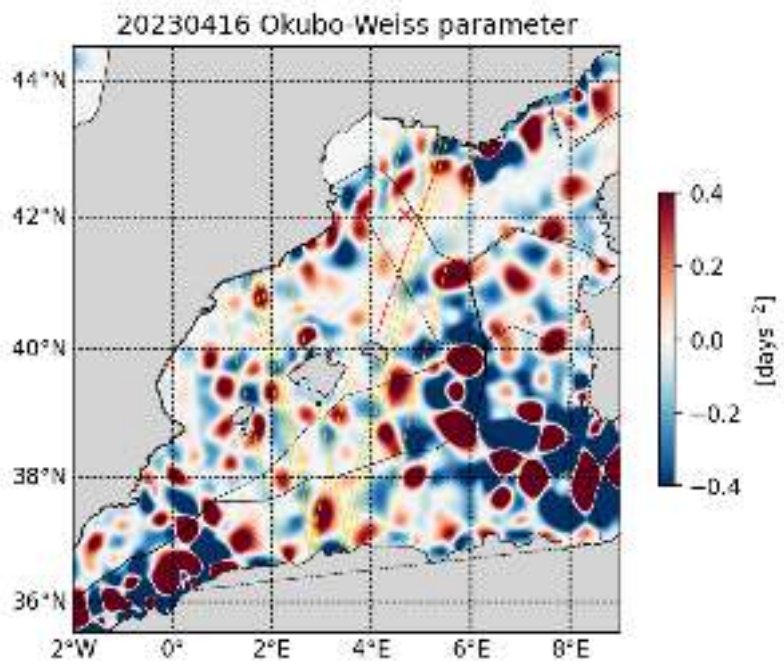
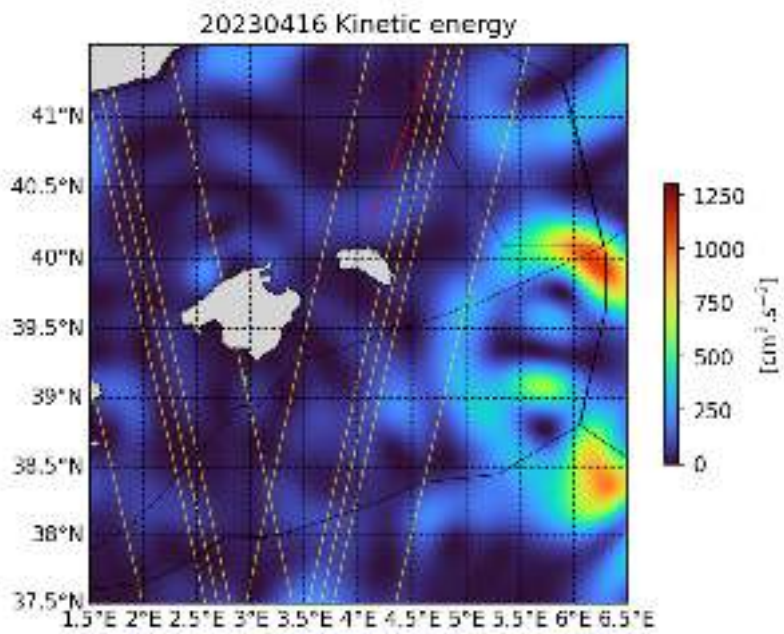
LLADV: longitude and latitude advection

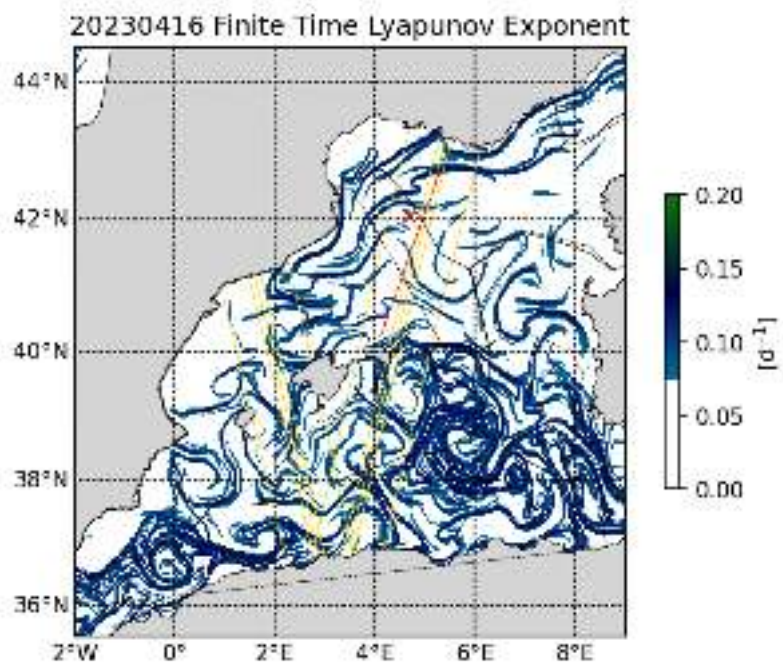
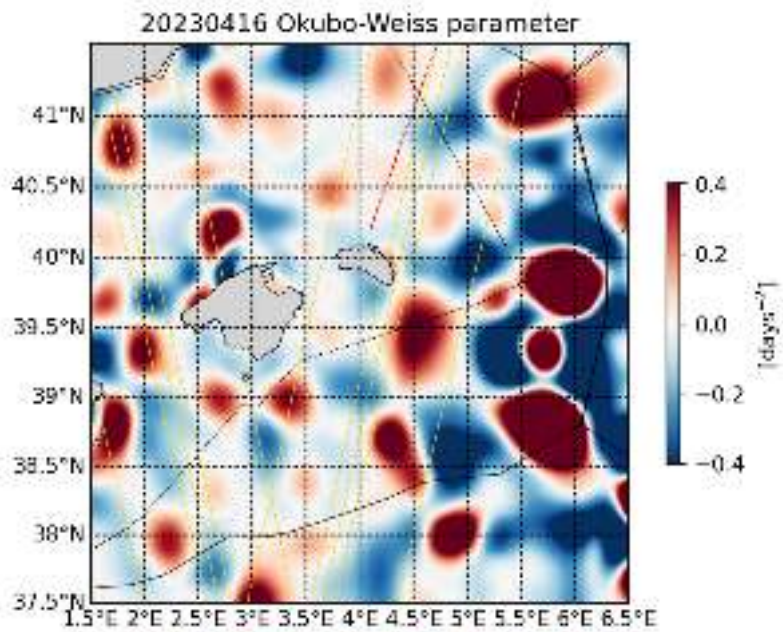
Retention parameter (based on computing the okubo Weiss parameter along a particle trajectory): Detect trapping structures (colorbar = days water parcels have a positive vorticity)

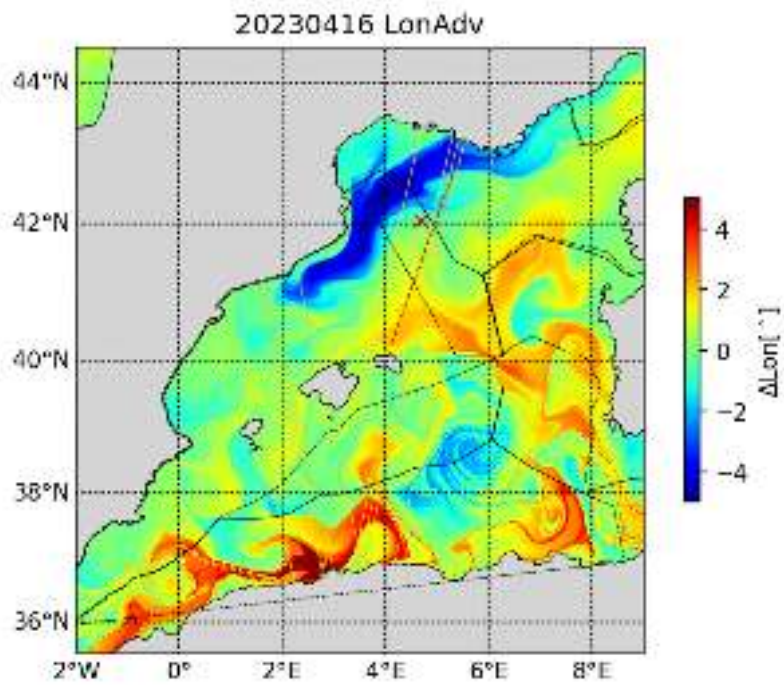
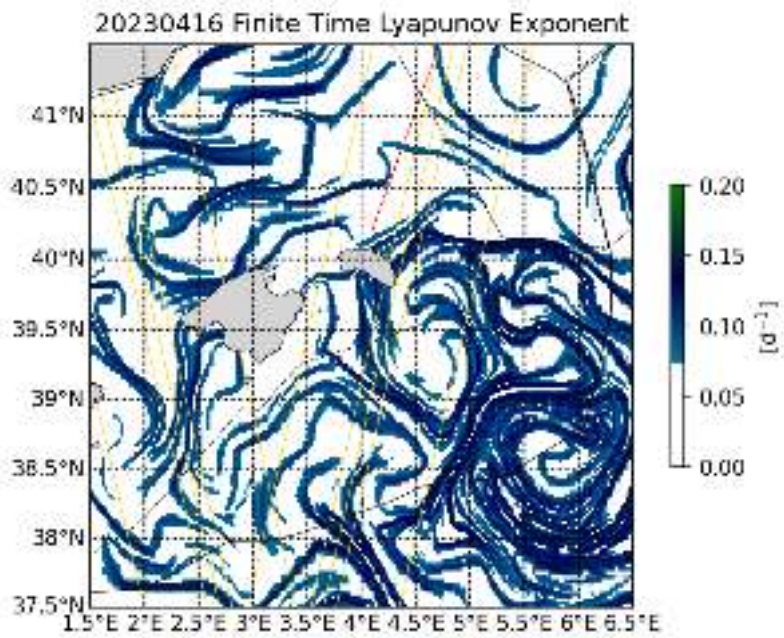
Timefrombathy: Water age since last contact with isobath XXm (precised in figure title)

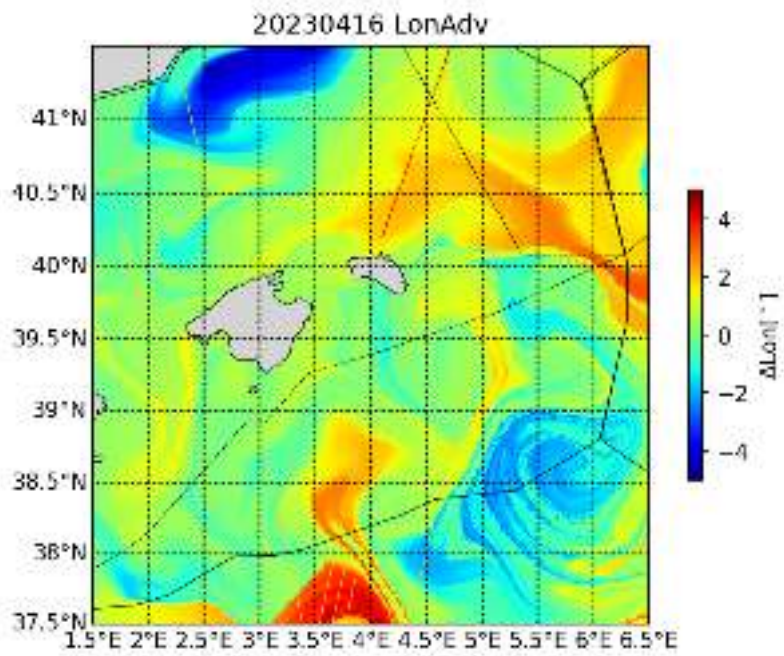
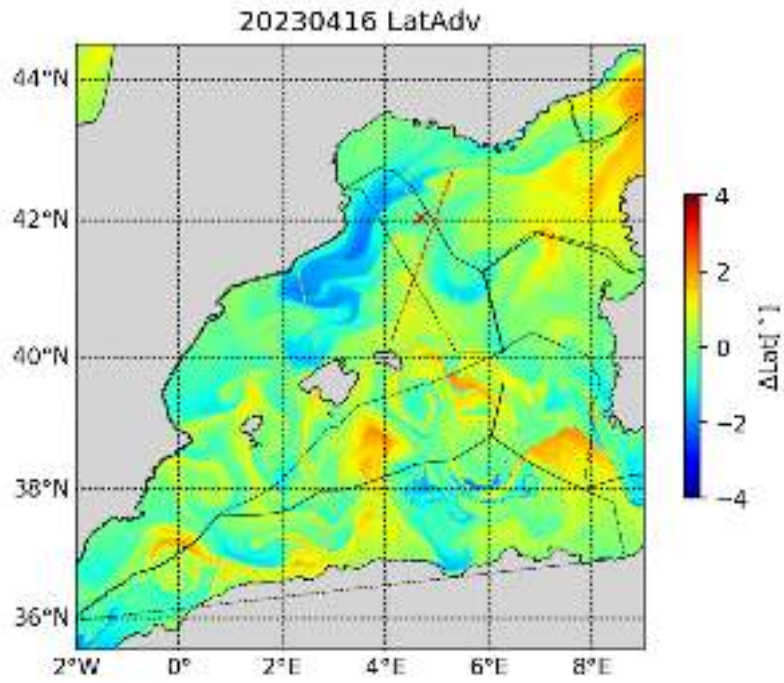
More details available at: <https://www.swot-adac.org/resources/swot-adac-products-access/>

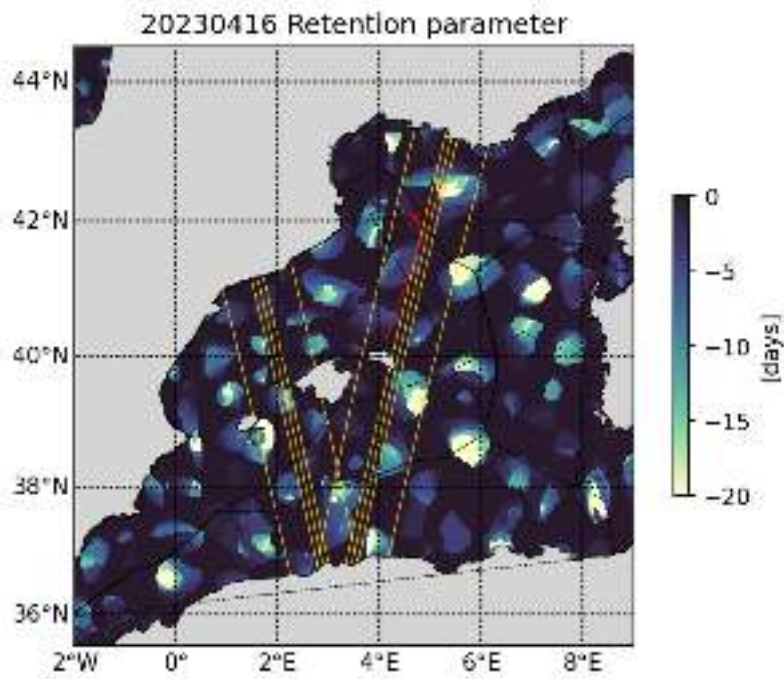
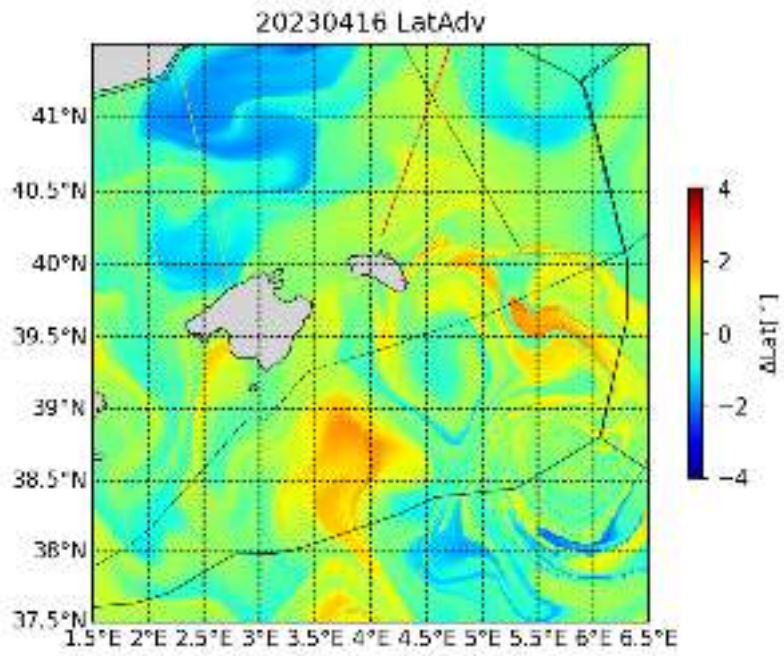


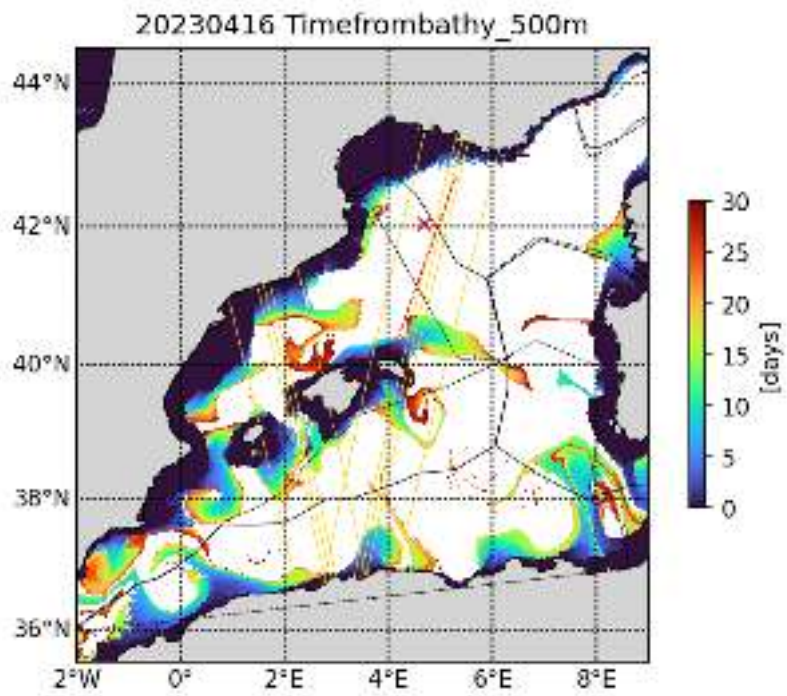
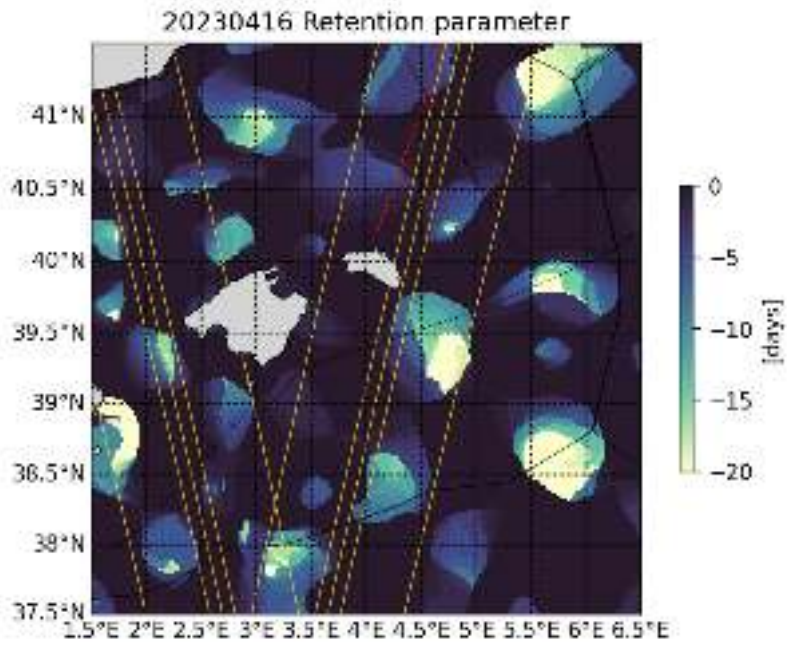


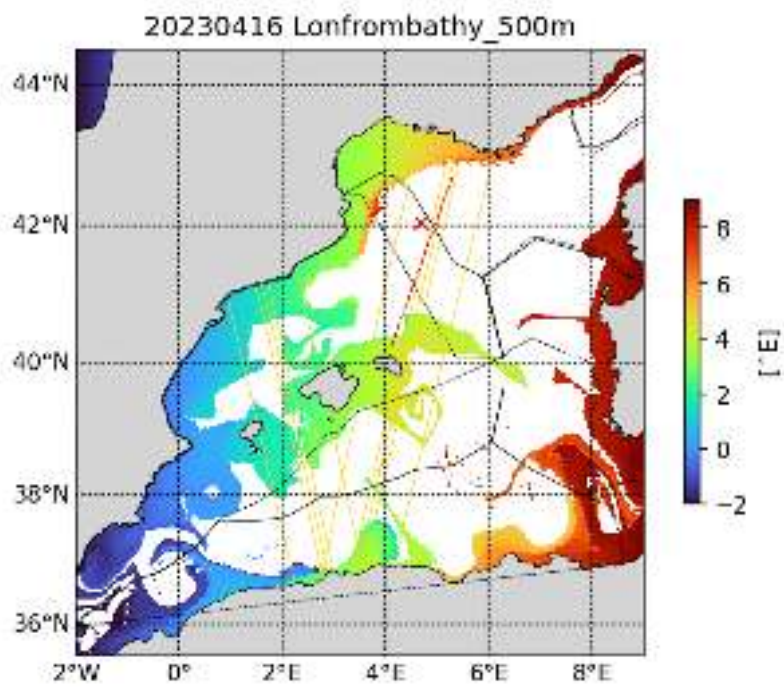
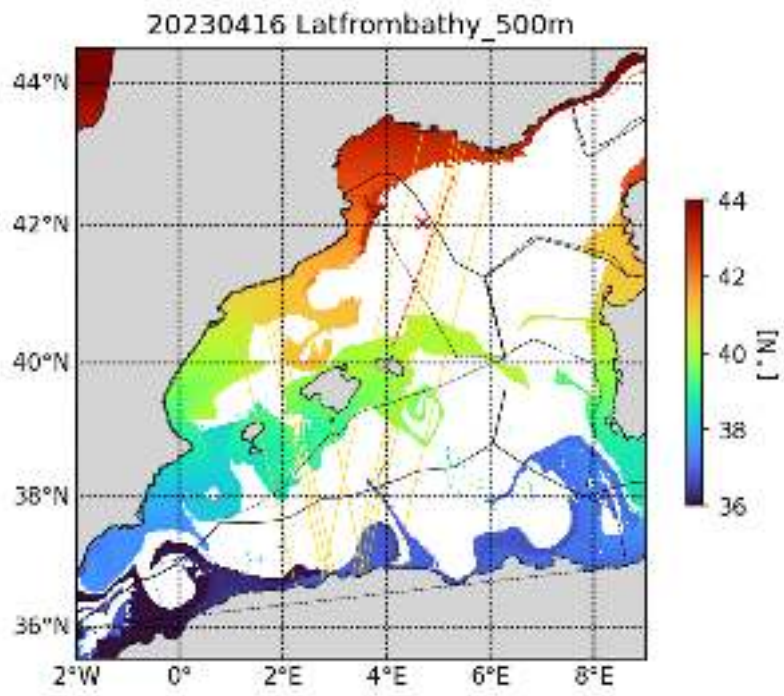


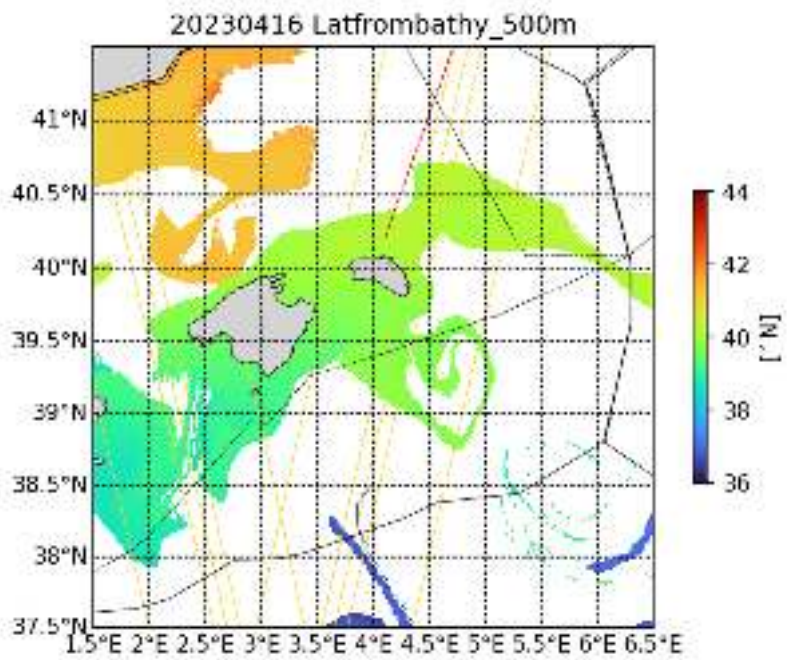
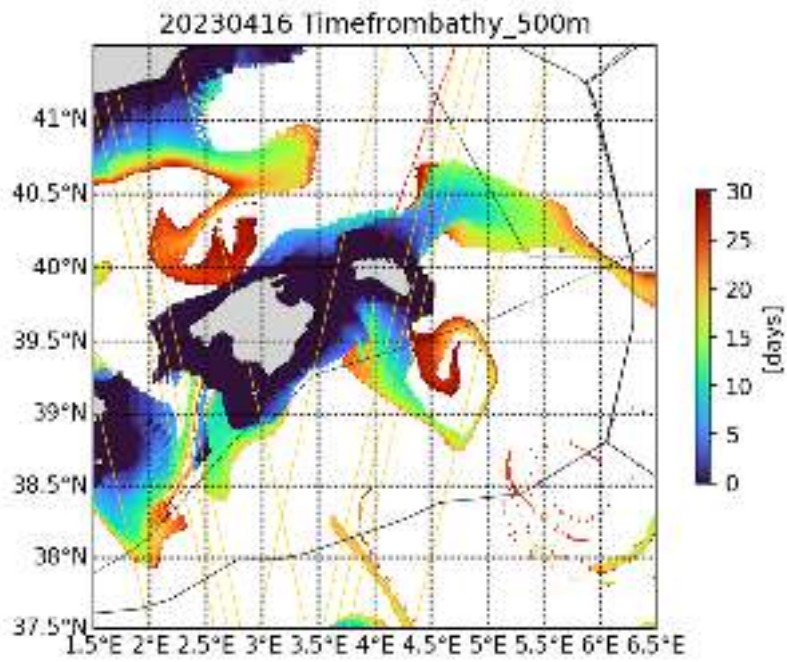


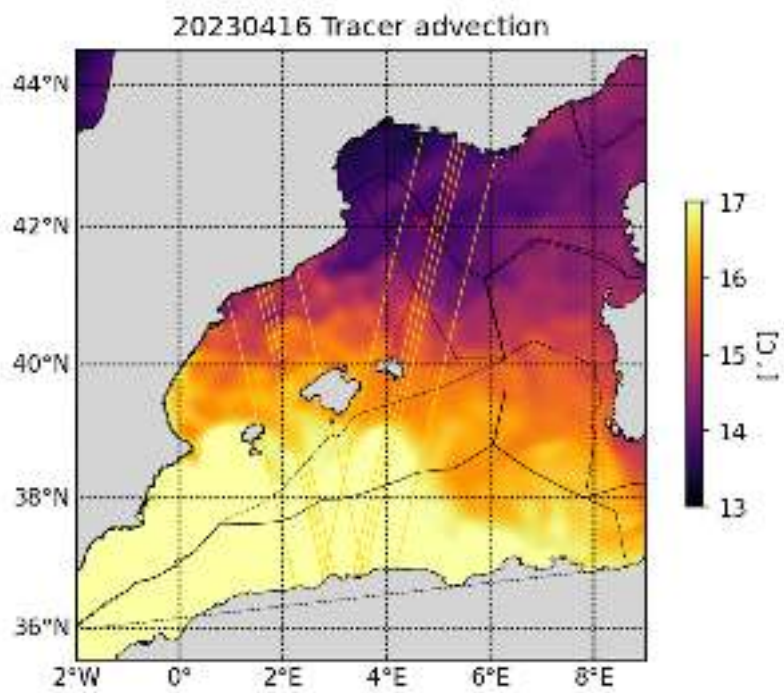
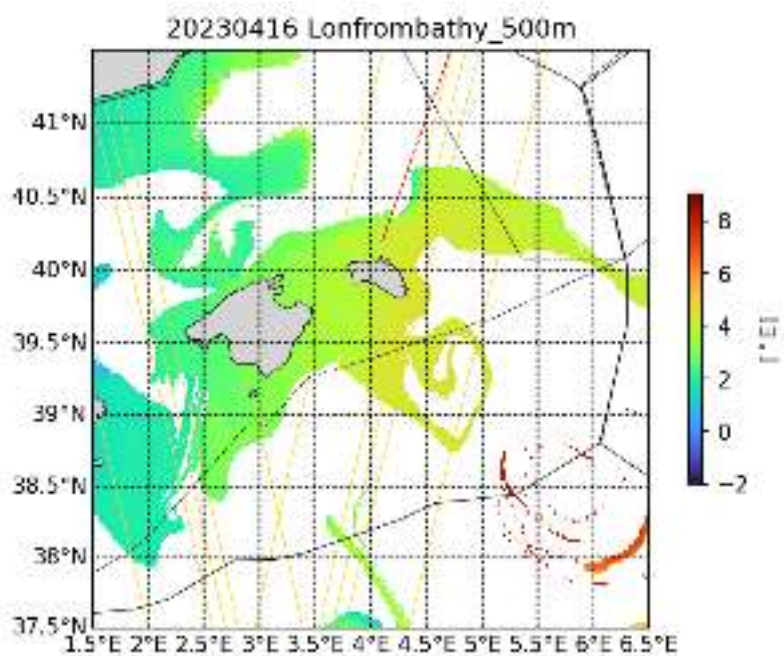




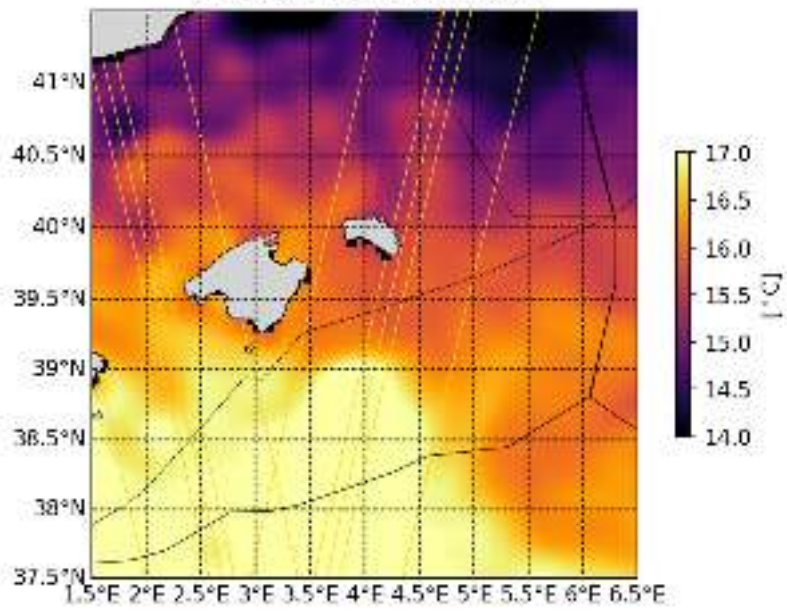






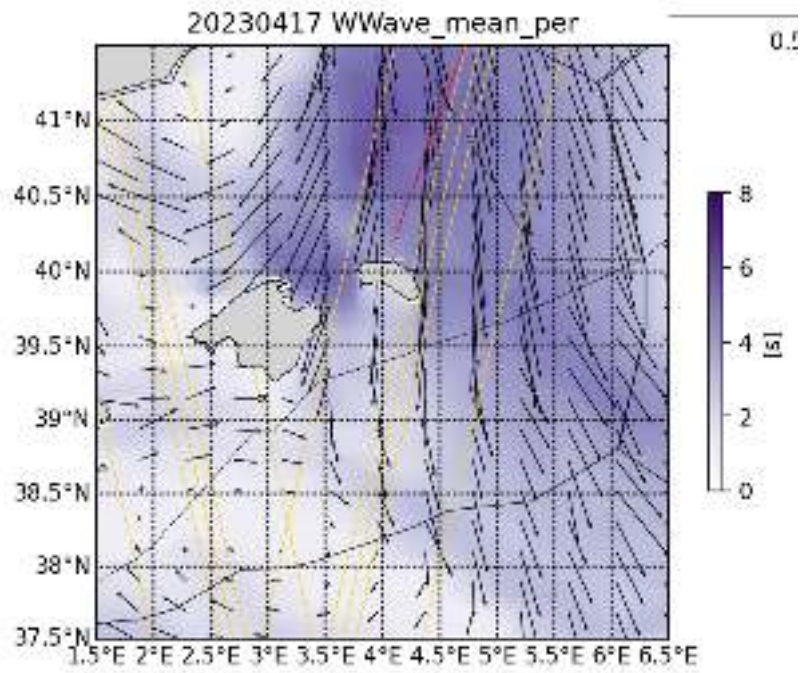
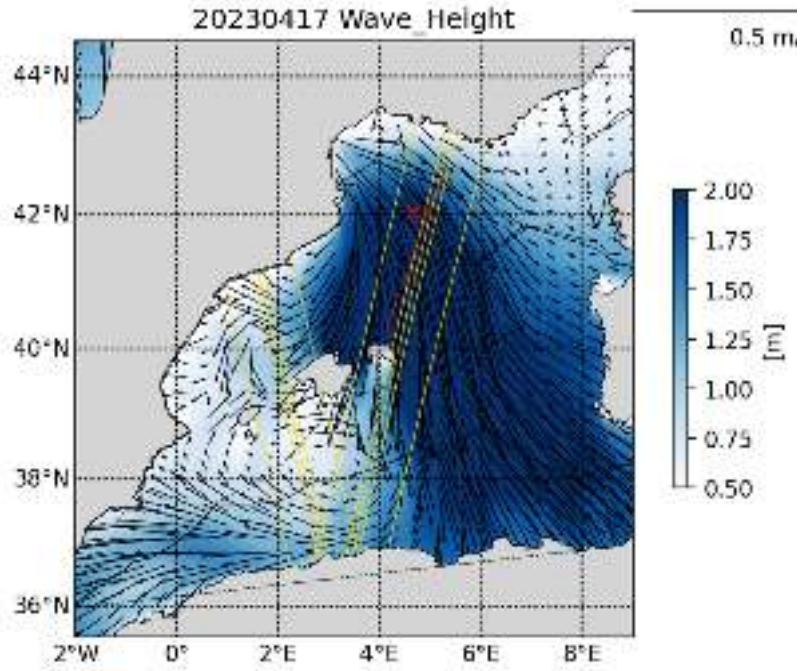


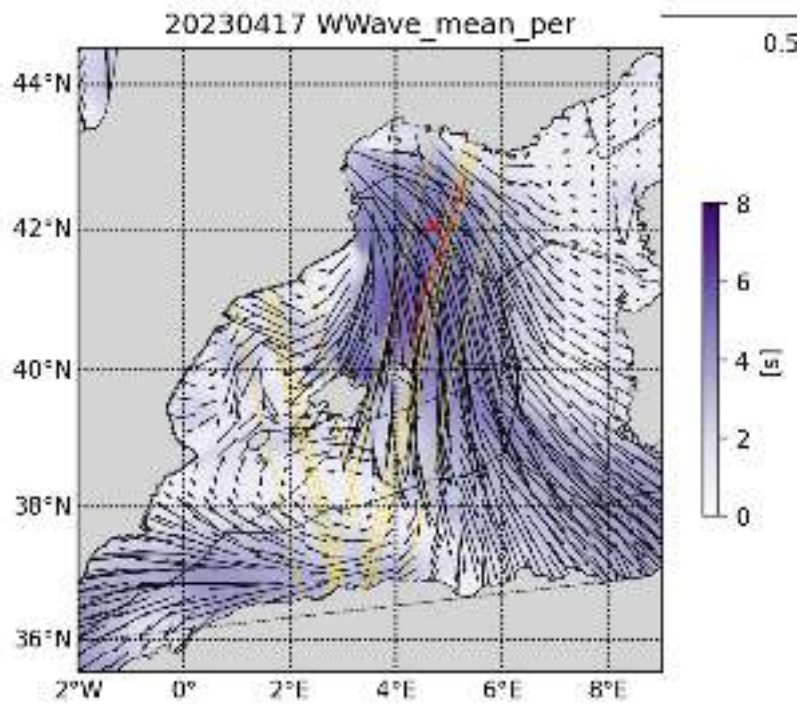
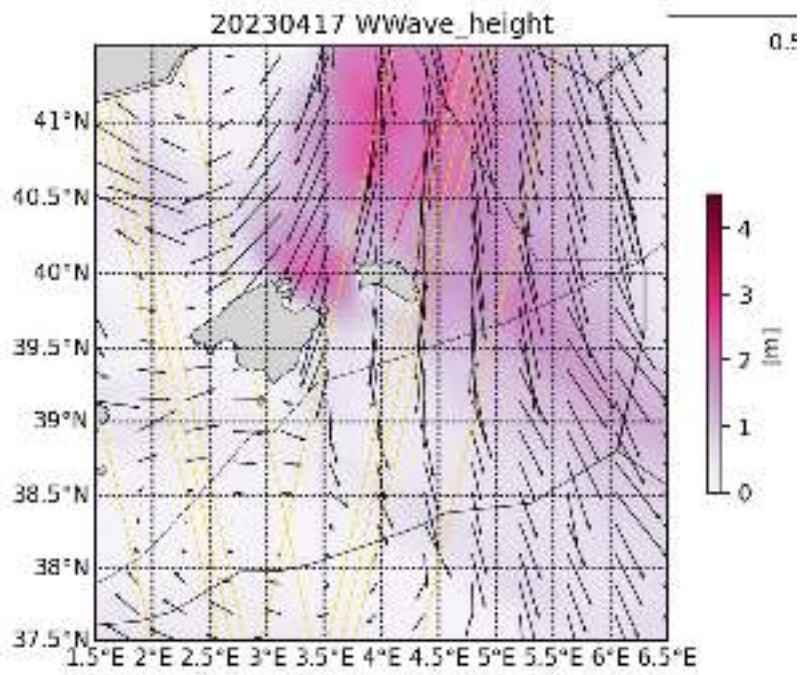
20230416 Tracer advection

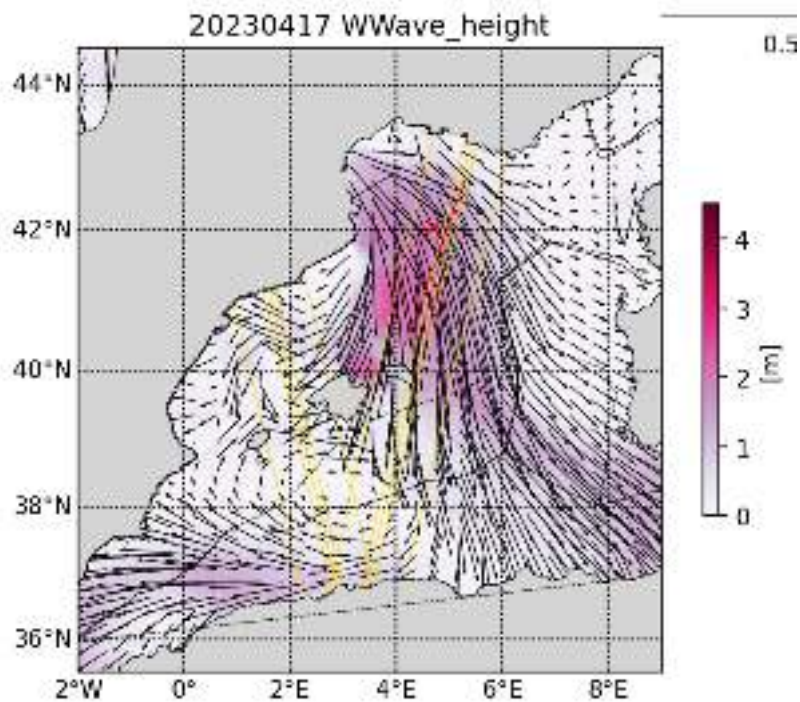
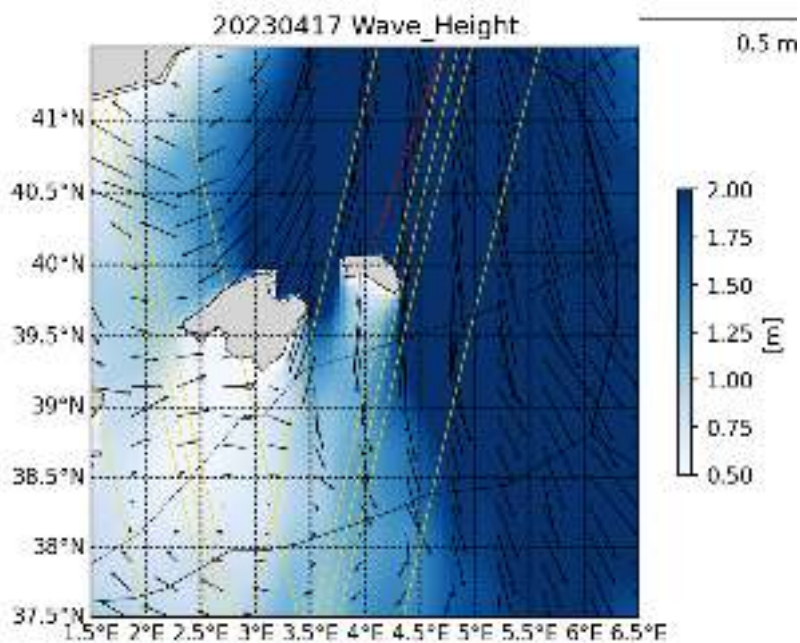


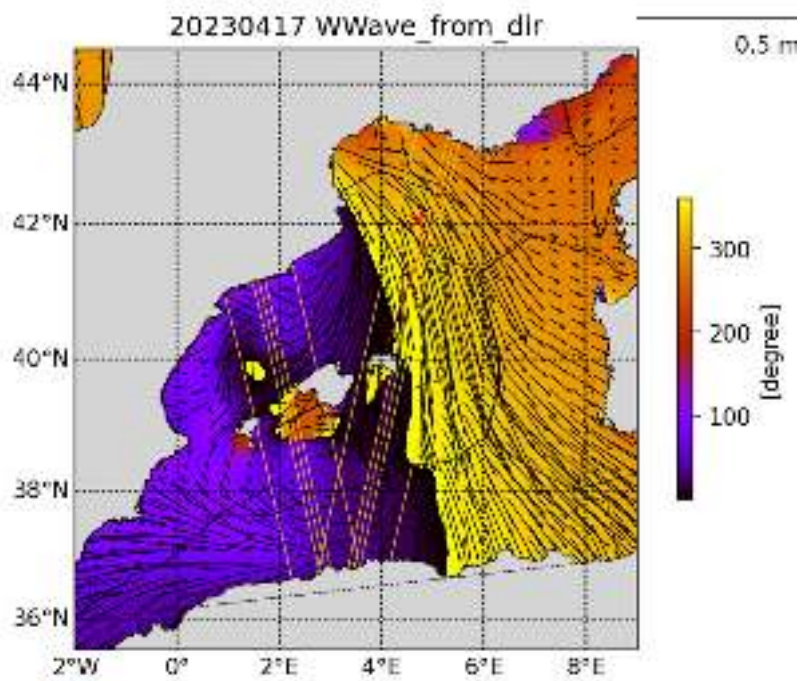
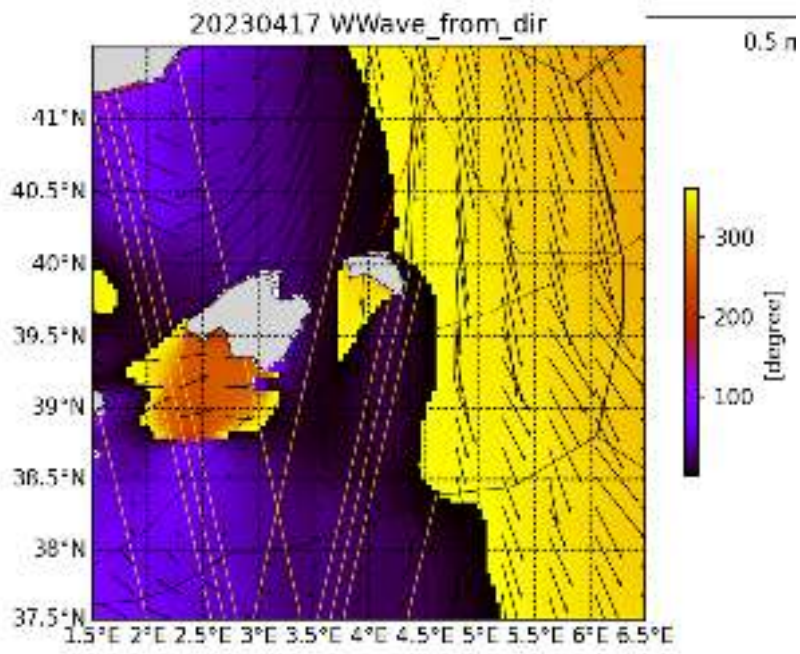
2.6 Wave forecast analysis

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Acknowledgments

Example:

The altimetry data are the AVISO Mediterranean regional product: <http://www.aviso.altimetry.fr/index.php?id=1275>. The derived currents are processed by SPASSO to derive Eulerian and Lagrangian diagnostics of ocean circulation: OkuboWeiss parameter, particle retention time and advection, Lagrangian Coherent Structures. CLS provided the SST and surface CHL concentration composite products. Sea surface temperature (level 3 and 4, 1 km resolution) and chlorophyll concentration (level 3, 1km resolution, MODISAqua and NPPVIIRS sensors combined (after May 27, 2017) into a new product called MULTI) have been provided by CMEMS Copernicus Marine Environment Monitoring Service (<http://marine.copernicus.eu>). Another SST product (level 4, composite, 1 km resolution) is provided by the Jet Propulsion Laboratory (JPL), Pasadena, CA. SPASSO is operated with the support of the SIP (Service Informatique de Pythéas) and in particular C. Yohia, J. Lecubin, D. Zevaco and C. Blanpain (Institut Pythéas, Marseille, France).